Fermilab

SAFETY NOTE #8

INEFFECTIVENESS OF ACOUSTIC TILES AS A SOUND ABSORBER

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As a method of controlling nuisance noise in computer rooms, several groups have installed (U.S. Gypsum) acoustic tiles. While these tiles meet Fermilab flammability requirements (0-25 flame spread), and are of tolerable appearance, they are of little value in controlling noise.

For example, if all available wall space in a typical computer room in Wilson Hall (3 walls, 1 large plate glass window) were completely lined with Gypsom acoustic tiling, a noise reduction of only approximately 3.0 decibels could be expected (see reverse side). Considering that the human ear cannot distinguish between sound pressure level changes of less than 3 decibels, little actual benefit would be obtained by their installation. Any perceived benefit would only be psychological in nature.

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See Reverse Side...

EXAMPLE COMPUTER ROOM

SURFACE	AREA (FT^2)	MATERIAL
Walls	666	Plasterboard
Ceiling	540	Gypsum Sound Absorbing Ceiling Panels
Floor	480*	10 ounce hairfelt or foam rubber carpet
Window	180	Plate Glass

*1/3 total floor space covered by computer hardware

Assume constant noise source of approximately 1000 Hz

α = absorption coefficient at 1000 Hz

The effect of introducing noise absorption can be calculated with reasonable accuracy as follows:

$$NR = 10 \log \frac{a_1}{a_2}$$

a_1 = absorption present before treatment of room in sabins

a_2 = absorption present after walls are covered with acoustic tiles in sabins

NR = sound pressure level reduction in decibels

SURFACE	AREA (FT^2)	α	SABINS	
Walls	666	0.04	26.64	
Ceiling	540	0.97	523.80	
Floor	480	0.34	165.24	
Window	180	0.03	5.40	
			721.08	a_1
Walls covered w/acoustic tiles	666	0.97	646.02	
Ceiling	540	0.97	523.80	
Floor	480	0.34	165.24	
Window	180	0.03	5.40	
			1,340.46	a_2

$$NR = 10 \log \left(\frac{1340.46}{721.08}\right) \doteq 2.7 \text{ dB}$$